IRC14-1354
03h. Plant and crop physiology and crop modelling

MORPHOLOGICAL CHARACTERIZATION OF COMPONENT TRAITS FOR LODGING RESISTANCE IN RICE

M.R. Laza[1], S. Shrestha[1], K.V. Mendez[1], M. Dingkuhn[2], M. Lopez[3]
[1]Crop and Environmental Sciences Division, International Rice Research Institute (IRRI), Los Baños, Philippines
[2]UMR AGAP, Centre de coopération internationale en recherche agronomique pour le dévelopement (CIRAD), Montpellier, France
[3]Research and Development, Syngenta Phils. Inc., General Santos, Philippines

Purpose:

The semidwarf plant architecture was key to the green revolution and proved effective in reducing lodging of rice. However, new cultivars with higher yield and harvest index, and the shift from transplanting to direct seeding, brought back lodging risks. Previous studies identified traits related to lodging resistance, but little is known on the interactions among them, how they relate to real lodging, and how they should be combined in new lodging resistant ideotypes.

Approach and methods used:

A model experiment using 20 rice genotypes with contrasting plant height, stem thickness, and yield was conducted in the 2013 wet (WS) and 2014 dry (DS) seasons to study the contribution of component traits to lodging resistance. We induced lodging at mid-grain filling stage with a new mobile field 'rice blaster' that generates wind stream (60 km h^{-1}) and simulated rain at plot scale. Canopy height was measured before 'blasting' and at different time intervals thereafter. Percentage lodging and recovery, stem morphological traits, and stem bending momentum were measured and their correlations determined.

Key results:

Bending resistance was positively and significantly correlated with peduncle length (r=0.51**) and internode number (r=0.45**). Positive correlations were observed between percentage lodging and canopy height (r=0.51*), culm length (r=0.45*), and number of internodes (r=0.39^{ns}). Interestingly, percentage lodging was negatively correlated with stem diameter (r=-0.39^{ns}). Although not significant, this indicates that several genotypes with thick stems were not lodging-resistant. Correlations of lodging recovery with canopy height (r=-0.64$^{**)}$, culm length (r=-0.58**), and peduncle length (r=-0.59**) were negative and significant. Plants with more internodes recovered less and those with thick stems had significantly greater recovery (r=0.51*).

Synthesis and Applications:

Results indicate that stem morphological traits alone cannot provide sufficient information to understand lodging resistance as generated here with the blaster. Other traits may be involved, such as stem anatomy and chemistry (nonstructural carbohydrates, lignins, fiber). Their relationships with morphological traits will be analyzed to fully explain lodging resistance, as well as the trade-offs between lodging resistance and yield potential. These ongoing studies will help phenotype and analyze genetically the relevant component traits for combined high yield potential and lodging resistance.